Earthquake Lesson – GIS Version

EXPLORING HUMAN RESPONSE TO NATURAL HAZARDS

Using the Internet and Information System (GIS)

Names of team members:

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Learning objectives:

1) How many medium-to-large earthquakes occur each day?

2) What conclusions can you draw about earthquake patterns based on geographic data?

3) Where is the pattern of human settlement in relation to earthquake patterns?

4) What is the pattern of economic development in relation to earthquakes, and what implications does this have on the local and global economy?

5) At what cost (risk) does physical geography begin to impair human development or enhance human development?

6) What other natural disasters are associated with earthquakes?

7) How can a GIS assist in analyzing earthquakes and human responses?

Let=s analyze data to explore the relationship between natural disasters and human responses. Why do people live where dangerous events could happen to them? Would you jeopardize your safety to live somewhere? We are going to use data from the Internet and organize the data graphically to help us draw some conclusions. Follow the directions step by step and you will make some discoveries about disasters and human responses to them.

Imagine you are coming to school. It could be August or January or May or any time in between. What are the threats you encounter in that 15 minutes each morning? List below and place a star by the ones that are caused by natural disasters:

Let=s pull up some earthquake data to see what people elsewhere face each day.

First, you will download information about earthquakes from the USGS National Earthquake Information Center that have occurred over the last several days. After you have the data, you will map these earthquake epicenters as point data. Before putting the data into your GIS, you will need to edit the epicenters file.

Follow these directions closely:

1)   Click on Netscape and find the line to put in an address for the computer to search.

2)   Go to the USGS National Earthquake Information Center by typing in this address:

        http://wwwneic.cr.usgs.gov/neis/bulletin/bulletin.html.

3)   Highlight all of the earthquake data that is under the line that states when the information was updated. For example: "Updated as of Thur April 3." The data that you should copy should look like this:

```
DATE-(UTC)-TIME     LAT     LON      DEP    MAG   Q   COMMENTS

97/04/21 07:38:46   35.02N 116.82W    5.0  3.4Ml A   CENTRAL CALIFORNIA
97/04/21 09:16:20   36.97N  71.90E  155.0  4.9Mb B   AFGHANISTAN
97/04/21 12:02:25   12.47S 166.21E   33.0  7.9Ms B   SANTA CRUZ ISLANDS
97/04/21 12:11:28   13.11S 166.24E   33.0  6.1Mb C   VANUATU ISLANDS
97/04/21 12:28:27   13.00S 166.00E   33.0  5.4Mb     SANTA CRUZ ISLANDS
97/04/21 12:39:11   13.00S 166.00E   33.0  5.1Mb     SANTA CRUZ ISLANDS
97/04/21 14:01:24    7.10S 125.59E  432.0  5.7Mb C   BANDA SEA
97/04/21 15:26:14   52.47N 172.24E   33.0  4.2Mb B   NEAR ISLANDS, ALEUT
97/04/21 20:35:04   13.51S 165.89E   33.0  5.3Mb C   VANUATU ISLANDS
97/04/21 21:02:14   36.43S  96.93W   10.0  4.9Mb B   WEST CHILE RISE
97/04/21 21:23:53   13.07S 166.19E   33.0  5.5Ms B   VANUATU ISLANDS
97/04/21 22:41:24   49.01S  75.35W   33.0  5.0Mb B   SOUTHERN CHILE
97/04/22 01:15:36   61.48N 150.45W   47.7  4.1Ml     SOUTHERN ALASKA
97/04/22 01:21:24   13.47S 166.55E   33.0  5.1Mb     VANUATU ISLANDS
97/04/22 05:55:50    3.25S 101.89E   33.0  5.6Mb B   SOUTHERN SUMATERA
97/04/22 09:31:26   10.97N  61.17W   33.0  6.5Ms A   TRINIDAD
97/04/22 10:11:49   10.97N  61.12W   33.0  5.7Mb A   TRINIDAD
97/04/22 10:18:55   11.12N  60.95W   33.0  4.8Mb C   WINDWARD ISLANDS
97/04/22 10:22:48   11.00N  61.10W   33.0  4.5Mb     TRINIDAD
97/04/22 11:18:08   37.43N 121.77W    9.7  3.3Ml     CENTRAL CALIFORNIA
97/04/22 12:45:49   10.95N  61.26W   33.0  4.4Mb     TRINIDAD
```

4)   Go to Edit, Copy, then Paste the data into a new NotePad document and edit the following:

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(1)   Take out any blank lines above DATE-(UTC)-
(2)   Remove line 2 -- yy/mm/dd hh:mm:ss deg. deg.   km
(3)   Remove all commas under the comments field. This is the field on
          the right hand side where a location is described.
(4)   Change S (south latitude) and W (west longitude) into negative
          numbers and remove the letters S and W. Remove the letters
          N and E.

```
97/04/21, 09:16:20,  36.97N,  71.90E, 155.0, 4.9Mb, B,  AFGHANISTAN
```

(5)   Add commas between each field in the title line and in the data itself.
(6)   Delete Mb, Ml, and Ms under the magnitude field.

```
97/04/21, 09:16:20,  36.97N,  71.90E, 155.0, 4.9, B,  AFGHANISTAN
```

Your final data should look like this:

```
DATE-(UTC),TIME,    LAT,    LON,     DEP,   MAG,   Q,   COMMENTS
97/04/21, 07:38:46,  35.02,  116.82,    5.0, 3.4, A,  CENTRAL CALIF
97/04/21, 09:16:20,  36.97,  -71.90, 155.0, 4.9, B,  AFGHANISTAN
97/04/21, 12:02:25,  -12.47, -166.21,  33.0, 7.9, B,  SANTA CRUZ IS
97/04/21, 12:11:28,  -13.11, -166.24,  33.0, 6.1, C,  VANUATU IS
```

5)   Save the data as an ascii text document and name it
          yourteamname.txt (for example: herrera.txt) in your folder.

Your data is now ready to bring to ArcView GIS.

6)   Open ArcView GIS.

Press Ctrl+N (creates new file)   OR: File-->New Project
Click Views
Click New
Press Ctrl+T (Adds theme) OR View-->Add Theme
Add the following themes for the 30 degree world latitude/longitude grid and the
1994 country boundaries:
                    world30.shp
                    cntry94.shp

Click on the small boxes associated with each theme to make them appear.

File-->Save Project OR Press Ctrl+S (saves project)

Important: Name your project as <yourteamname>.apr in your folder. Write the
name of your project on a piece of paper.

7)   Add your earthquake data.
       Click once on Tables.
       Click Add.

In the lower left of the window, change the field to delimited text (*.txt)
     Find your text file in your folder and click OK

Your table name should now appear in the list of tables along with a window with the data.

8)   Click on the View window to make it active.

        Go to the View menu on the top and select Add Event Theme.

                Your text file should appear.
                Click OK.
                Note that x is longitude, y is latitude.

Make the theme appear by clicking on the small check box next to it.

Now you are ready to analyze the data you have mapped and draw some conclusions about it.

9)   Examine the pattern of earthquakes.

What are three noticeable characteristics of your pattern of earthquakes?

10)   Add the theme Aplat_lin.shp≅. These are the boundaries of the crustal plates.

What is the pattern of earthquakes related to plate boundaries?

Look at the **magnitude** of earthquakes related to plate boundaries. Is there a relationship? Why or why not?

Look at the **depth** of earthquakes related to plate boundaries. Is there a relationship? Why or why not?

11)   Add the theme cities. View--> Add theme. Zoom in on the world map and analyze the location of earthquakes and look at major cities. Single click on cities.shp in the legend (not on the check mark) and drag it below the earthquake theme.

What is the pattern of earthquakes related to cities? Are most cities near earthquake epicenters?

12) Add population density. What is the pattern of earthquakes related to population density? What implications does this have?

13) Add the theme Agnp.shp≅. This is the Gross National Product (GNP) by country.

Note how all the countries are the same color. Change this to a map showing 5 categories of GNP.

Double click on the theme gnp.shp to bring up the legend editor.

Change the legend type from Asingle symbol≅ to Aunique value.≅
Change the values field from Anone≅ to AGNP≅.

What is the pattern of earthquakes related to GNP?

14) How is economic development impacted by earthquakes, and what implications does this have on the local and global economy?

15) What other natural disasters are associated with earthquakes? How does this affect your answer to question 14?

16) At what cost (risk) does physical geography begin to impair human development or enhance human development?

17) Press Ctrl+S **or** File--> Save Project to save your work with yourteamname.apr as the project name.

18) Note how all the earthquake epicenters are the same color. Change this so that each day=s earthquakes are mapped with a different color.

Double click on the theme earthquake.txt to bring up the legend editor.

Change the legend type from Asingle symbol≅ to Aunique value.≅
Change the values field from Anone≅ to Adate-(UTC)≅.

Look at the >count= to the right of each category. Which day witnessed the most earthquakes? Is there a pattern? Why or why not?

19) Now you are ready to create a final plot of your data. All the information you wish to include in the final plot will be in the Alayout.≅

Click on layout, then New.

Click on Frame button (last one on right on button bar).

Drag to first choice (looks like a globe) to add a view frame.

Draw a rectangular frame on the layout.

Click on View1 to insert view into frame.

Go to second choice under the frame button (looks like a legend).

Draw a rectangular frame to create your legend.

Go to 4th choice under the frame button (north arrow).

Draw a rectangular frame to create your north arrow.

Click on the AT≅ button to add text on button bar.

Click in Layout.

Type in text. You should include the following items of text:
              Your name(s).
              Title of Map.
              Date the map was created.

Experiment with different fonts, styles, and locations of text to make your map as pleasing to the eye as possible.

20)   Plot your layout to the printer:

        File-->Print.

21)   Repeat this entire exercise with another natural hazard. Add the new data as an additional event theme and map the hazard as a separate theme to your existing ArcView project. Be sure to save your project often.

22)   What is the pattern of this additional hazard? in relationship to physical features on the map? Why?

23)   What is the pattern of this additional hazard in relationship to cities? Why?

24)   What is the pattern of this additional hazard in relationship to earthquakes? Why?

end